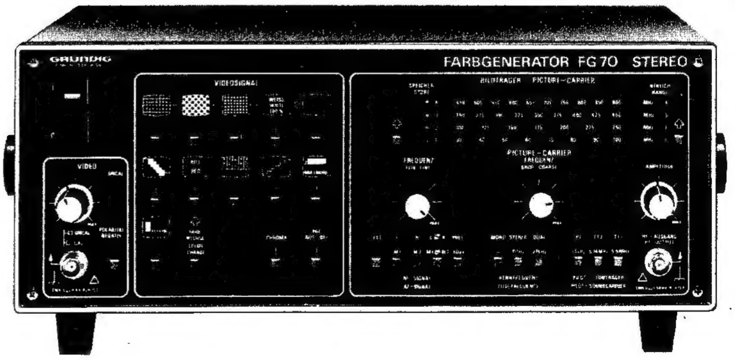
FARBGENERATOR FG 70 Stereo



COLOR GENERATOR FG 70 STEREO

OPERATING INSTRUCTIONS

Editor: GRUNDIG AG
Geschäftsbereich ELECTRONIC

Table of contents

1 Introduction

This **Color Generator FG 70 Stereo** from GRUNDIG Electronic is suitable for use in the entire field of television engineering – development, production, and service. Following the current trend in the television market, the instrument is furnished with a comprehensive audio section that provides all signal types needed for stereo and dual sound systems.

The particular requirements of video recorder technology are satisfied f.e. by including a moving test pattern which is indispensible when checking tape travel functions.

The RF section covers an uninterrupted tuning range of appr. 30 MHz to appr. 900 MHz. This also includes all channels used by cable television and makes the instrument fit to meet future developments.

2 Technical Data

The technical data are based on the specifications as outlined in the German standard DIN 43745. Where no tolerances have been indicated, the values are intended for your orientation and represent the characteristics of the average sample unit.

2.1 Environmental conditions

Ambient temperatur

Nominal operating temperatur range	+5°C ... 40°C
Reference value	23°C
Reference-value tolerance	±1°C
Limit values for storage and transport	−20°C ... +60°C

Relative humidity

Nominal operating range I	20% ... 80%
Limit values for storage and transport	10% ... 90%

Atmospheric pressure

Nominal operating range I	70.0 ... 106.0 KN/m

2.2 Power supply

The supply line has to be in accordance with the VDE regulations 0411 (DIN 57411), Part 1, 10/73 and Part 1b/2.72.
Protection class II

Nominal voltage	220 V
Tolerance	±1%
Rated operating range	220 V 10%
Nominal frequency	50 Hz
Tolerance	± 1%
Rated operating range	50 Hz ... 60 Hz
Distortion at nominal voltage	β = 0.05
Power consumption	25 W

2.3 Physical construction

Dimensions

Width	356 mm
Height	160 mm
Depth	275 mm
Weight	≧ 7 kg

2.4 Test patterns

Grid pattern	17 vertical 12 horizontal lines
Amplitude B, G, I, D, N M, NTSC	700 mV ±3% 714 mV ±3%
Amplitude difference between horizontal and vertical lines	< −10%

Chequerboard pattern

Number of squares	like grid pattern
Amplitude B, G, I, D, N M, NTSC	700 mV ±3% 714 mV ±3%

Dot pattern

Dot position	Lattice-points of grid

100% white screen

Amplitude B, G, I, D, N M, NTSC	700 mV ±3% 714 mV ±3%

Circular test

Can be superimposed on Grid, Checkerboard, and Dot pattern	
Deviations in diameter	≦ 2%
Diameter changes within temperature range +5°C...+40°C	≦ 2%
Amplitude B, G, I, D, N M, NTSC	700 mV ±3% 714 mV ± 3%

Standard color bars 8 vertical bars of decreasing brightness

PAL B, G, D, N	Weiß white	Gelb yellow	Cyan cyan	Grün green	Magenta magenta	Rot red	Blau blue	Schwarz black
Leuchtdichte Luminance	700 mV	465 mV	368 mV	308 mV	217 mV	157 mV	60 mV	–
Farbamplitude U_{ss} Chroma amplitude	–	470 mV	664 mV	620 mV	620 mV	664 mV	470 mV	–
PAL I								
Leuchtdichte Luminance	700 mV	640 mV	543 mV	483 mV	392 mV	332 mV	235 mV	–
Farbamplitude U_{ss} Chroma amplitude	–	470 mV	664 mV	620 mV	620 mV	664 mV	470 mV	–
PAL M								
Leuchtdichte Luminance	714 mV	492 mV	401 mV	344 mV	257 mV	201 mV	110 mV	54 mV
Farbamplitude U_{ss} Chroma amplitude	–	440 mV	628 mV	283 mV	583 mV	628 mV	440 mV	–
M, NTSC								
Leuchtdichte Luminance	549 mV	492 mV	401 mV	344 mV	257 mV	201 mV	110 mV	54 mV
Farbamplitude U_{ss} Chroma amplitude	–	440 mV	628 mV	283 mV	583 mV	628 mV	440 mV	–
Alle Normen: All standards:								
Farbphasenwinkel U_{ss} Chroma phase angle	–	167,0°	283,5°	240,5°	60,5°	103,5°	347,0°	–

Tolerance for color carrier amplitude: ±5%
Tolerance for chroma phase angle: ±3%
Tolerance for luminance signal: ±5%
} with the exception of PAL M, N, NTSC

Vector test pattern

Five vectors $\pm BA_V$, $+BA_U$, (G–Y) = 0, $+BA_V$, $\pm BA_U$

Gray level reference in the lower quadrant (Y portion of vectors)

Luminance signal: B, G, I, D, N 263 mV
M, NTSC 301 mV

Chroma amplitude: $U_{pp} \approx 525$ mV

Chroma phase angle:
for all PAL standards

$\pm BA_V$ vector:	90°/270°	±2°
$+ BY_U$ vector:	0° ±2°	
(G – Y) = 0:	±146°	±3°
$+ BY_V$ vector (achromatic)	90°	±2°
$\pm BA_U$ vector (achromatic)	0°/180°	±2°

for NTSC

1. vector (+Q axis)	+ 33°	±3°
2. vector (+ I axis)	+ 123°	±3°
3. vector (G–Y) = 0	+ 146°	±3°
4. vector (–Q axis)	+ 213°	±3°
5. vector (–I axis)	+ 303°	±3°

Monochromatic red screen

All individual colors contained in the color bar pattern may be selected to cover the entire screen by actuating the button "Color Change" (including white and black burst).

Specifications like for color bar test pattern.

Linear gray scale

Linear scale from black to white in 8 steps

White bars: B, G, I, D, N 700 mV ±3%
M, NTSC 714 mV ±3%

Deviations of each level ≦ 3%

Multiburst

6 frequency groups of 50% gray level with 100% white bar reference.

Y portion	B, G, I, D, N M, NTSC	350 mV 384 mV
White reference	B, G, I, D, N M, NTSC	700 mV 714 mV
Frequency groups	0.5 MHz, 1 MHz, 2 MHz 3 MHz, 3.5 MHz, 4.8 MHz	
Wave form	sinusoidal without gap between frequencies	
Amplitude:	B, G, I, D, N M, NTSC	U_{pp} = 700 mV U_{pp} = 660 mV

Additional functions

Chroma button: Color, including burst, can be turned off.

PAL button: PAL switch-over can be turned off. Only original vectors are transmitted. Out of function with NTSC button pressed.

Polarity button: Video polarity can be reserved.

button : White bar moving from left to right, can be introduced into normal image, grid pattern, chequerboard, dot pattern, color bars, and monochromatic screen.

Test lines

Two lines at the start of each field contain white as a reference.

1. field: lines 17 + 18

2. field: lines 330 + 331

Amplitude for all standards 700 mV

2.5 Signals

Color subcarrier

The color subcarrier is permanently coupled to the line frequency including the 25 Hz offset.

Color subcarrier:	PAL B, G, I, D	4, 433, 619 Hz ±5Hz
	PAL N	3, 582, 056 Hz ±5Hz
	PAL M	3, 575, 611 Hz ±5Hz
	M/NTSC	3, 579, 545 Hz ±5Hz

Temperature drift: $\leqq \pm 5 \cdot 10^{-6}$ within the temperature range +5°C ... +40°C

Burst phase PAL: ±135°±2° according to PAL standard NTSC: 180°±2°

Burst amplitude: ±50% of sync. amplitude ±10%

Burst position:	PAL B,G,I,D,N	5.6 µsec	following the
	PAL M	5.8 µsec	leading edge of
	M, NTSC	5.4 µsec	line sync pulse
Burst width:	PAL B,G,I,D,	2.25 µsec ±0.23 µsec	
	PAL M,N,NTSC	2.52 µsec + 0.28 µsec	
Burst keying:	PAL:	according to applicable pulse standard with quadruple sequence	
	NTSC:	9 lines during pre-, main-, and post-equalizing pulse	

Blanking and synchronizing signals

Line frequency: B, G, I, D, N 15, 625 Hz $\pm 1 \cdot 10^{-5}$
M, NTSC 15, 724.26 Hz $\pm 1 \cdot 10^{-5}$

Synchronizing pulse width: 4.7 µsec

Synchronizing pulse amplitude:
B, G, I, D, N 300 mV ± 3%
M, NTSC 286 mV ± 3%

Horizontal blanking: 12 µsec

Front black porch: 1.5 µsec

Field frequency: B, G, I, D, N 50 Hz $\pm 1 \cdot 10^{-5}$ interlaced
M, NTSC 60 Hz $\pm 1 \cdot 10^{-5}$ interlaced

Frame synchronization signal:

B, G, I, D, N 5 equalizing pulses (= 2.5 lines) 5 main pulses (= 2.5 lines) 5 equalizing pulses (= 2.5 lines)

M, NTSC 6 equalizing pulses (= 3 lines) 6 main pulses (= 3 lines) 6 equalizing pulses (= 3 lines)

Vertical blanking: B, G, I, D, N 25 lines + 12 µsec
M, NTSC 20 lines + 12 µsec

Pedestal: B, G, I, D, N 0%
M, NTSC 7.5% = 53,5 mV

2.6 Outputs

Color carrier: BNC connector on rear panel
Output voltage V_{pp} = 2V±0.5V at 75Ω
Output resistance R_i = 75Ω

Trigger output: BNC connector on rear panel
A switch below the socket allows to select one of the following output signals: blanking signal A, field signal (50 Hz) V/50, and frame singal (25 Hz) V/25.
Output voltage V_{pp} = 4V±0.5V at 75Ω
Positive pulse
Output resistor R_i = 75Ω

Video output: BNC connector on front panel
Output voltage
calibrated V_{pp} = 1V at 75Ω
uncalibrated V_{pp} < 2.4V at 75Ω
Output resistor R_i = 75Ω ±5%
Polarity reversible by pushbutton

AV socket: DIN connector on rear panel
Pin configuration:
1: activating voltage +12 V
2: video output V_{pp} = 1 V at 75 Ω
3: ground
4: L/mono 1 V_{eff} = 0.5 V, R_i ≈ 10 kΩ
5: supply voltage +12 V (10.5 ... 12.5V) via diode in series
6: R/mono 2 V_{eff} = 0.5 V, R_i = 10 kΩ

AF socket: DIN connector to input external AF signals
Pin configuration:
3: L/mono 1 V_{eff} = 0.5 V, R_i ≈ 470 kΩ
5: R/mono 2 V_{eff} = 0.5 V, R_i ≈ 470 kΩ
2: ground

2.7. RF Section

2.7.1 Video carrier generator

Frequency range: 1 f_{VC} < 37 MHz ... > 100 MHz
2 f_{VC} < 100 MHz ... > 225 MHz
3 f_{VC} < 225 MHz ... > 470 MHz
4 f_{VC} < 470 MHz ... > 850 MHz

Frequency stability: typical $\pm$ $1x10^{-3}$/10 min following 15 min warmup time;
typical $\pm$ $3x10^{-4}$/10 min following 1 hr warmup time;

Temperature effect on frequency: typical $\pm$ $5x10^{-4}$/K

Video modulation: A 5 C neg double-sideband

RF sync level: $U_{sync} = V_{VC} \cdot 100\%$
$P_{sync} = 0$ dB

Standard: B, G, D, K, H, K1, M, N, I

RF black level:	**Standard:**
$U_{blk} = V_{VC} \cdot 76\%$ $P_{blk} = -2.4$ dB	I
$U_{blk} = V_{VC} \cdot 75\%$; $P_{blk} = -2.5$ dB;	H, M, N
$U_{blk} = V_{VC} \cdot 73\%$; $P_{blk} = -2.7$ dB;	B, G

RF white level:

f_{VC}	< 470MHz	> 470 MHz	**Stand.**
$U_{wht} = V_{VC} \cdot 20\%$ $U_{wht} = -14$ dB	+4/−3% 3 dB	+6/−4% ±4 dB	I
$U_{wht} = V_{VC} \cdot 12.5\%$ $P_{wht} = -18$ dB	+4/−3% ±3 dB	+6/−4% ±4 dB	D, K
$U_{wht} = V_{VC} \cdot 10\%$ $P_{wht} = -20$ dB	+4/−3% ±3 dB	+ 10/−2% + 6/−2 dB	B, G, H K1, M, N

Sound carrier/vision carrier separation	**Stand.**
FG **Mono:** $\frac{V_{SC1'}}{V_{VC}}$ = 23 dB (13 dB*)	I
FG **Mono:** $\frac{V_{SC1'}}{V_{VC}}$ = 23 dB (13 dB*)	I
FG **Mono/Stereo:** $\frac{V_{SC1'}}{V_{VC}}$ = 23 dB (13 dB*)	D,K,K1 H,M,N
FG **Stereo:** $\frac{V_{SC2'}}{V_{VC}}$ = 30 dB (20 dB*)	B,G B,G

2.7.2 Sound carrier generator

Sound carrier frequency:	**Standard:**
FG 70 **Mono:** f_{SC1} = 4.5 MHz	M,N
FG 70 **Stereo/Mono:** f_{SC1} = 5.5 MHz	B,G,H
FG 70 **Stereo:** f_{SC2} = 5.7421875 MHz	B,G,H
FG 70 **Mono:** f_{SC1} = 6.0 MHz	I
FG 70 **Mono:** f_{SCQ} = 6.5 MHz	D,K,K1

Frequency tolerance:
see tolerance of reference frequency

Reference frequency:

f_R = 62.5 kHz combained with f_H; (f_Q = 4.0 MHz*);

Tolerance of reference frequency:

$\frac{\Delta f_Q}{f_Q} \leqq \pm 2 \cdot 10^{-5}$;

Temperature effect on reference frequency:

$\frac{\Delta f_Q}{f_Q} \leqq \pm 5 \cdot 10^{-5}$; in the range +5 ... +50 °C

(* Values in parantheses optional);

PLL comparison frequency:

$f_{PLL} = \frac{15626 \text{Hz}}{2} = 7812.5$ Hz; ($\dot{f}$ H:2);

Progr.divider:	
f_{SC1} = 4.5 MHz;	n = 576
f_{SC1} = 5.5 MHz;	n = 704
f_{SC2} = 5.7421875 MHz;	n = 735
f_{SC1} = 6.0 MHz;	n = 768
f_{SC1} = 6.5 MHz;	n = 832

Frequency modulation:

internal **AF deviation 1**
$\Delta f_{SC1} = \pm 30$ kHz; (mono, dual)*
$\Delta f_{SC1} = \pm 15$ kHz; (stereo, L/R)*
AF deviation 2 B, G
Δf_{SC2} = + 30 kHz;*
at f_{AF} = 500 Hz/4 kHz*
without pre-emphasis;
Pilot carrier deviation B, G
$\Delta f_{SC2} = \pm 2.5$ kHz;

external: **AF deviation 1**
Δf_{SC1} = + 30 kHz; B, G
(mono/dual) V_E = 0.5 V
$\Delta f_{SC1} = \pm 15$ kHz;
(stereo, L/R) V_E = 0.5 V
$\Delta f_{SCmax} \leqq$ = 150 kHz;
V_E = 2.5 V
AF deviation 2
$\Delta f_{SC2} = \pm 30$ kHz;
V_E = 0.5 V
$\Delta f_{SCmax} \leqq \pm 150$ kHz;
V_E = 2.5 V
f_{AF} = 100 Hz ÷ 15 kHz
(typ 0.5 dB);
f_{AF} = 40 Hz ÷ 40 kHz
(typ 3 dB);

Pilot carrier deviation
see internal modulation

* note: when using pre-emphasis overmodulation for $f_{AF} \leqq 500$ Hz!

Modulation distortion:
K_{total} = 0.4%
at $\Delta f_{SC1/2} = \pm 30$ kHz; f_{AF} = 500 Hz ÷ 10 kHz

Signal-to-noise ratio:
P = 50 dB; f_{SC} = 5.5 MHz or 5.742 MHz;
vision carrier generator "OFF";
Mod. F_{AF} = 500 Hz/4kHz external;
Deviation $\Delta f_{SC} = \pm 3$ kHz (V_e = 50 mV);
pre-emphasis (50 usec) "ON";
5.5 MHz or 5.742 MHz FM demodulator with de-emphasis 50 µsec!

Pre-emphasis:

	Standard:
φ = 50 µsec, P_{500Hz} = 0 dB	
P_{4kHz} = +4 dB	B,G,D,K
P_{10kHz} = +10.5 dB	
P_{15kHz} = +14 dB	K1,H,I

2.7.3 AF Generator

Frequency: FG 70 **Stereo:** — **Standard:** B,G

$f_{L/M1}$ = 488 Hz
(15.625 Hz : 32);
$f_{R/M2}$ = 3906 Hz);
(15.625 Hz : 4);

2.7.4 Pilot carrier generator

FG 70 Stereo: — **Standard:** B,G

Frequency: f_{PC} = 54,687.5 Hz
(15,625 Hz · 3.5);
with horizontal frequency sync. (PLL);

Frequency tolerance: see tolerance f_H
$(\frac{\Delta f_H}{f_H} = \pm 1 \cdot 10^{-5})$

Amplitude modulation: m = 50%;
with identification frequencies
f_{KS}/f_{KD}

Identifikation frequency generator

Frequency: **FG 70 Stereo:** — **Standard:** B,G

Mono: f_{IM} = 0 Hz;
Stereo: f_{IS} = 117.5 Hz;
(15,625 Hz : 133)
Dual: f_{ID} = 274.1 Hz;
(15,625 Hz : 57);

Frequency tolerance: see tolerance f_H
$(\frac{\Delta f_H}{f_H} = \pm 1 \cdot 10^{-5})$

2.7.5 AF Signal linkage

FG 70 Stereo:

	AF channel 1 (f_{SC1})	**AF channel 2** (f_{SC2})	**Standard:**
Mono:	M1 or M2	M1 M2	B,G
Stereo:	$M = \frac{L+R}{2}$	R	
	or $M = \frac{R+L}{2}$	L	
Dual:	M1 or M2	M2 M1	

Crosstalk:

Stereo: P = 40 dB; right to left;
f_{AF} = 500 Hz/4 kHz;
P = 60 dB; left to right;

Dual: P = 60 dB; mono 1 to mono 2;
mono 2 to mono 1;

2.7.6 AF input

Af socket according to DIN 41524
Contact 3: L/M1 input (mono)
Contact 5: R/M2 input (stereo)
Contact 2: ground

FG 70 Stereo: — **Standard:** B,G

$V_{in,1/2}$ = 0,5 V for
FM: $\Delta f_{SC1/2} = \pm 30$ kHz; (mono/dual)
$\Delta f_{SC1/2} = \pm 15$ kHz; (stereo);
f_{AF} = 100 Hz ÷ 15 kHz; (typeo. 0.5 dB)
R_{in} = 470 kΩ;

Note: $f_{AF} \geqq 500$ Hz when using pre-emphase over-modulation!

see 2.7.2 FM external

2.7.7 AF output

AV socket according to DIN 45322/45482

Contact 4: L/M1 output (mono)
Contact 6: R/M2 output (stereo)
Contact 3: ground

AF internal: **Fg 70 Stereo:** — **Standard:** B,G

$V_{out,L/M1}$ = 0.5 V;
$V_{out,R/m2}$ = 0.5 V;
$f_{AF,L/M1}$ = 488 Hz;
(15,625 Hz : 32);
$f_{AF,R/M2}$ = 3906 Hz;
(15,625 Hz : 4);
$R_{out,L/M1}$ = 1 kΩ;
$R_{out,R/M2}$ = 1 kΩ;

AF external: **Fg 70 Stereo** — B,G

$V_{out,L/M1} = V_{in,L/M1}$;
$V_{out,R/M2} = V_{in,R/M2}$;
$R_{out,L/M1}$ = 1 kΩ;
$R_{out,L/M2}$ = 1 kΩ;

2.7.8 RF output

BNC socket

RF voltage

$V_{out,VC}$ = 16 mV; P_{VC} = 84 dB µV;
synchronous value at 75 Ω;
f_{VC} = 37 MHz ÷ 850 MHz;

FG 70 Stereo: — B,G

$V_{out.SC1}$ = 40 mV; P_{SC1} = 92 db µV;
$V_{out,SC2}$ = 18 mV; P_{SC2} = 85 dB µV;
at 75 Ω;
f_{SC1} = 5.5 MHz;
f_{SC2} = 5.742 MHz;

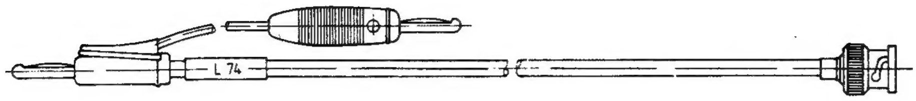
RF output resistance: R_{out} = 75 Ω

RF output divider: a = 0 ÷ ≧ 60 dB;

3 Accessories

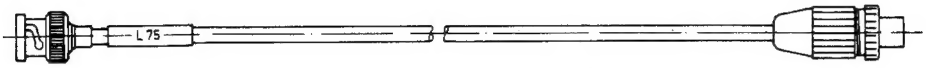
H.UJ 66–24 **Connecting cable L 74**

Co-axial cable of 1 m length, provided with BNC connectors and two banana plugs.
Wave impedance 75 Ω.



H.UJ 66–21 **Connecting cable L 75**

Co-axial cable, provided with BNC connector and 60/75 Ω plug (according to DIN 45325/IEC 169-Z) to connect the RF output with the antenna input of TV units or recorders. Length appr. 1.5 m, wave impedance 60/75 Ω, capacity appr. 130 pF.



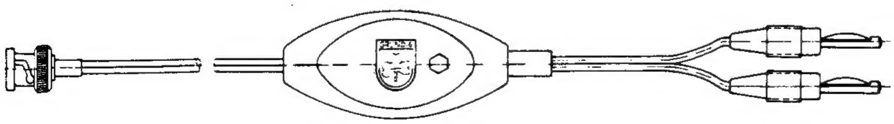
H.UJ 66–22 **Connecting cable L 76**

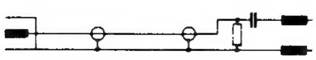
Coaxial cable with BNC connectors on both ends, 1 m long, wave impedance 75 Ω.

G.UJ 65–10 **Video connecting cable VK 5**

Coaxial cable with BNC connector and 75 Ω terminating resistor in a plastic housing at the other end with a separating capacitor. Two banana plugs serve for the connexion to the test object. For direct feeding of video-frequency signals into the circuit.

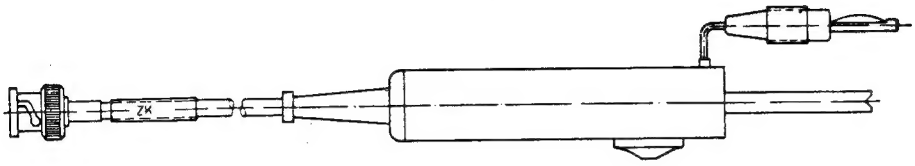
Length appr. 1.5 m, wave impedance 75 Ω.





G.UJ 75-01 **Gripper clamp ZK 75**

Coaxial cable with one BNC connector and a gripper (clamp). The cable is terminated with 75 Ω in the gripper. The clamp is connected to the hot end of the terminating resistor via 4700 pF.
For direct feeding of RF voltages into the test object. Length appr. 1.5 m.

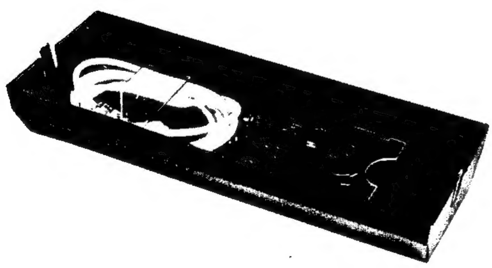


G.EA 04-00 **Connecting cable 242**

5-wire cable, 2 m long, with 5-pin AF connectors. For feeding an external AF signal.

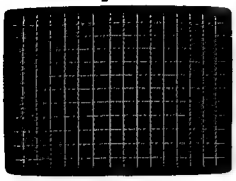
G.UB 30-02 **Front protector hood FH 1**

This rigid plastic hood covers the controls of the FG 70 S and also accomodates the connecting cables.



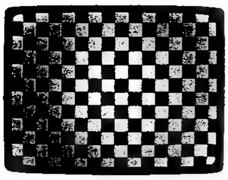
The "General Catalog Measurement Instruments" of GRUNDIG Electronic lists additional accessories and provides further details.

Grid pattern



(28)

Checkerboard



(29)

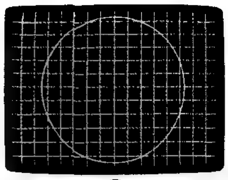
Dot pattern

(30)

100% white

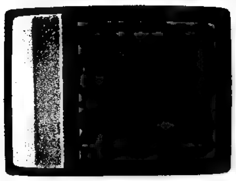
(31)

Test circle (can be co



(32)

Standard color bars



(33)

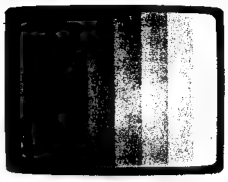
Red screen

(34)

Demod. test pattern

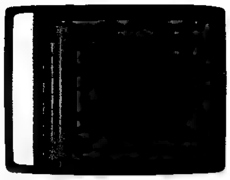
(35)

Linear grey scale

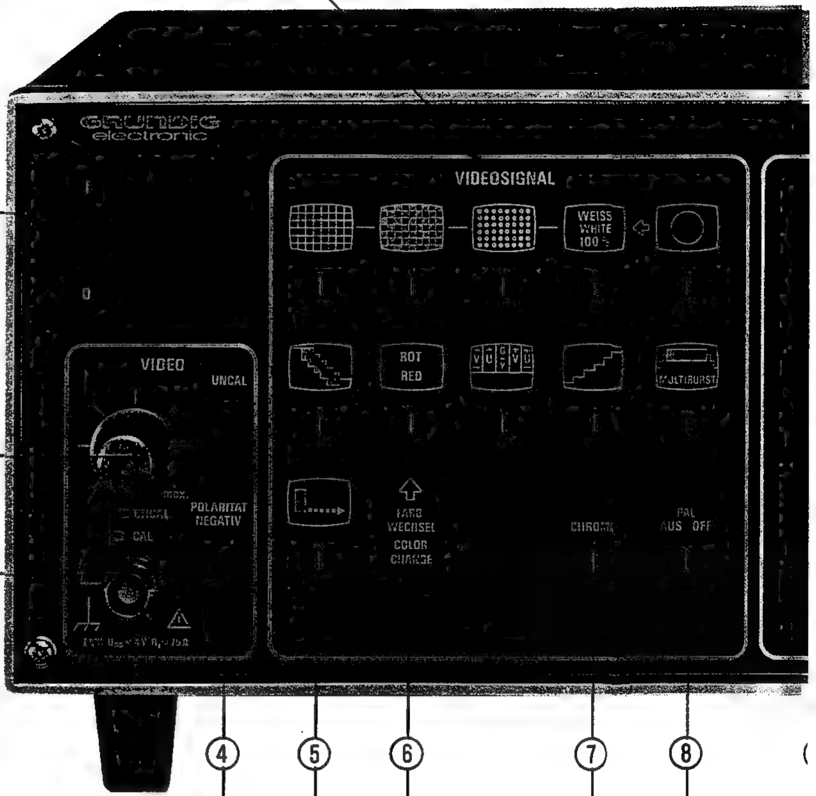


(36)

Multiburst



(37)



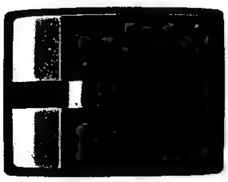
Power switch
The operating condition is indicated by various indicating lights.

Video amplitude
Rotational knob pressed: video voltage at (3) is calibrated to $V_{pp} = 1V/75\Omega$. Rotational knob pulled ("uncal" indicator lights up): video voltage at (3) can be adjusted to $V_{pp} = 0 \ldots 2{,}4 V/75\Omega$.

Video output
Select the level using (2). (4) provides polarity reversal.

Video polarity
Reverse the polarity positive/negative by pressing this button. The indicator lights up with negative signal polarity.

Moving test pattern
White bar moving from left to right. May be combined with grid pattern, checkerboard, dot pattern, color bars, color areas.



The picture shows the combination with (33).

Advance button for color areas
Button (34) switches to red screen. The advance button (6) allows to fill the entire screen with every one of the colors contained in the standard color bars (33).
Sequence:
red, magenta, green, grey, yellow, white, black (black burst), blue.

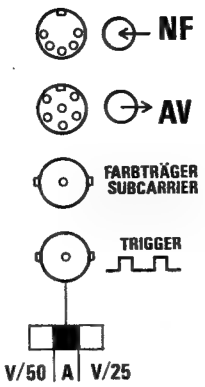
Color information
The pushbutton allows to switch ON/OFF. Indicator lights up when "chroma" is on.

PAL identification
The pushbutton allows to switch ON/OFF. Indicator lights up when "PAL" is off.

External AF signal
Indicator-on condition: signals at socket (38) are used for modulation. Indicator-off condition: L/M1 internal 488 Hz
R/M2 internal 3.9 kHz

d with (28) (29) (30))

Rear panel



(38) DIN socket for feeding an external AF signal L/R, V_{eff} = 0.5V, Ri = 470 kΩ (Δf_{SC} = ±30 kHz)

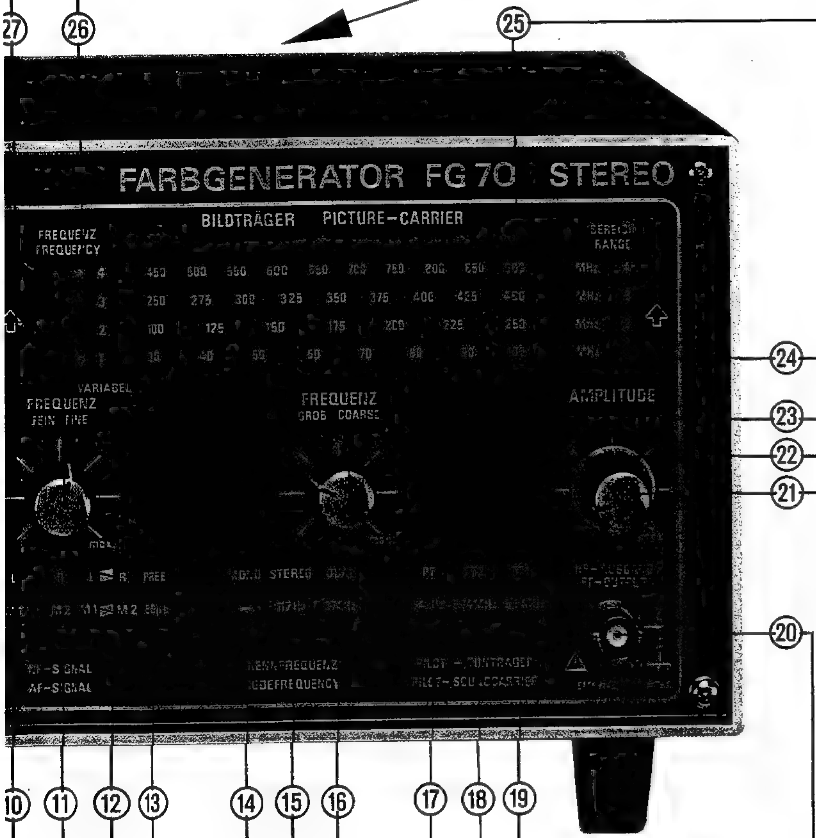
(39) AV-DIN socket, V_{AF} = 0,5 V/1 kΩ

(40) BNC socket, V_{pp} = 2V at 75Ω

(41) BNC socket, signal switch-over to blanking signal (A), frame signal (25 Hz), field signal (50 Hz).

Advance button for vision carrier frequency
For the selection of the **"variable"** mode, the four fixed frequencies or the **"vision carrier OFF"** operation. In **"variable"** mode select the frequency range with button (24) and adjust the exact frequency using (22) and (23).
In **"vision carrier OFF"** operation none of the five indicators lights up, not even the frequency indicator (25) and the frequency range indication.

Fixed frequencies
One frequency can be preset for each of the four selectable ranges. Use (23) for fine adjustment.



Frequency indication
The light band in combination with the scale below indicates the adjusted vision carrier frequency.

Advance button "Frequency range"
To select the desired range. In operation only if mode is set to "variable" (27). Use (22) and (23) for frequency adjustment.

Selector "Frequency fine"
For precise adjustment of the vision carrier.

Selector "Frequency coarse"
Covers the entire range selected via button (24). In operation only when operating mode set to "variable" (27).

Selector "RF output Level"
Adjustable to a = 0...≧60 dB

BNC socket for RF output
Level adjustable with selector (21)
When VC is OFF:
SC 5.5 MHz/5.74 MHz

Pilot sound 54 kHz
Indicator-on condition:
54 kHz frequency modulation of sound carrier 2.

Pre-emphasis
The pushbutton allows to switch ON/OFF. Indicator lights up when pre-emphasis is switched on.

Left-right interchange
Indicator-on condition: L/M 1 = 3.9 kHz
R/M 2 = 488 Hz

Modulation right side
R/M 2 = 3.9 kHz

Modulation left side
L/M 1 = 488 Hz

Sound carrier 2
5.742 MHz when vision carrier is OFF, SC2 is available at output (20) with 18 mV/75Ω.

Sound carrier 1
5.5 MHz when vision carrier is OFF, SC1 is available at output (20) with 40 mV, 75Ω.

Mono operating mode
No amplitude modulation of pilot sound.
M1 on SC1 and SC2.

Stereo operating mode
117 Hz amplitude modulation of pilot sound.
$\frac{L+R}{2}$ on SC1, R on SC2

Dual operating mode
274 Hz amplitude modulation of pilot sound.
M1 on SC1, M2 on SC2.

5 Startup

5.1 Power connection

Before connecting the instrument, confirm that the data specified on the instrument name plate coincide with those of the supply line. The Color Generator FG 70 S is designed for operation at a line voltage of 220 V (tolerable range appr. 200 V ... 260 V). Factory conversion for operation at 110 V (tolerable range appr. 100 V ... 140 V) is possible.

5.2 Setting up the unit

Do not operate the FG 70 S in the close vicinity of equipment with significant heat dissipation! The handle bracket may be used to tilt the FG 70 S which makes operating the instrument more convenient.

5.3 Switching on

The instrument is switched on with button ①. Various LED indicators light up and indicate that the unit is in operation.

5.4 Signal connection

The connecting cables for the different connectors are described in section 3 (Accessories).

5.5 RF adjustment

Tuning to the receiving frequency of a connected color TV unit or recorder starts with the selection of a fixed frequency or of the "variable" operating mode using advance button ㉗. In "variable" mode the frequency is determined with advance button ㉔. The frequenc can now be tuned to match the receiver using selector "Frequency coarse" ㉒. Selector "Frequency fine" ㉓ serves for the precise adjustment. Take care to use the proper sideband. When tuning from lower toward higher frequencies the first possible noise-free setting corresponds to the proper sideband. Use selector ㉑ to adjust the RF output level to noise-free playback.

5.6 Internal audio signals

a) Mono operating mode

For this mode of operation press buttons ⑩, ⑭, and ⑲. Then button ⑫ allows to set the modulation frequency to 3.9 kHz (indicator ⑫ lights up) or 488 Hz (indicator ⑫ extinguishes). Button ⑪ needs not to be actuated.

b) Stereo operating mode

Select stereo mode by pressing button ⑮ and adjust pilot sound ⑰, sound carrier 1 ⑲ and sound carrier 2 ⑱.
Select right modulation M2 = 3.9 kHz and/or left modulation M1 = 488 Hz using buttons ⑩ and ⑪, respectively.
Button ⑫ allows to interchange the modulation frequencies. The light-up condition for indicator ⑫ is L/M1 = 3.9 kHz, R/M2 = 488 Hz.

c) Dual channel operation

Use button ⑯ to select dual channel operation; for all other functions procede as for stereo operation.

5.7 External audio signals

Socket ㊳ (AF input) or socket ㉘ (AV input) on the rear panel can be used to feed in an AF signal for modulation. Press button ⑨ to accept this external signal. Select right and/or left modulation by actuating ⑩ and/or ⑪; use button ⑫ for modulation interchange.

6 Application of the various est patterns

6.1 Grid pattern ㉘

This signal pattern is intended for adjusting the horizontal and vertical convergence and its static and dynamic properties. Button ㉛ allows in addition to superimpose the circular test pattern. Adjust linearity in vertical and horizontal direction in such a fashion that the horizontal and vertical lines form squares.

An optimum correction of pincushion distortion is achieved when the squares in the corners are identical to the squares in the center. Convergence adjustment and the correction of pincushion distortion can be interactive!

The different brightness of vertical and horizontal lines suggests an amplitude problem (frequency response problem) of the Y channel.

The vertical white lines have a half-band width of appr. 200 nsec. The display of these lines allows conclusions about the amplitude characteristics of the television unit. Blurred vertical lines may result from poor amplitude response. Multiple lines are due to the tendency to oscillate.

6.2 Checkerboard ㉙

The application of this test pattern is similar to that to the grid pattern. Here too, the circular pattern can be superimposed. It is especially useful for tests according to the square wave method. For this purpose, the video signal is evaluated with an oscilloscope.

6.3 Dot pattern ㉚

The dot pattern is particularely suitable for evaluating the image definition. It is also a good means to examen the static convergence.

6.4 100% white screen ㉛

The 100% white area is of importance for setting the maximum beam current (beam current limitation).

In case of video recorders the white level setting of the FM demodulator can be compared suitably well with this signal.

The color purity can be evaluated when studying the test image on the screen with a magnifying glass.

6.5 Circle pattern ㉜

The circular ring may be superimposed upon test patterns ㉘, ㉙, and ㉚. It serves mainly for evaluating the overall geometry and linearity across the screen. As the circle is located precisely in the image center it allows an exact determination of the image position.

6.6 Standard color bars ㉝

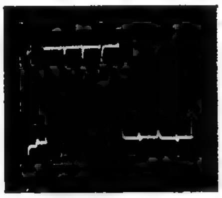
These color bars of decreasing luminance (white bar 100%, color saturation 100%, chroma amplitude 75%) are suitable for the visual inspection and measurements of the entire color section. The screen display is used to evaluate color tone and color saturation.

Oscillograms can be taken throughout the entire color section of color TV units and recorders. Errors in different stages are easily identified from their characteristic signals.

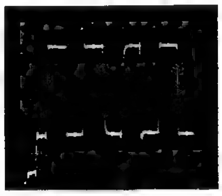
The complete color information can be switched on or off using button ⑦.

Where a vector scope is available, differential phase and amplitude errors can be detected from the color bar signal. The following traces show the signals at the image tube control electrodes with RGB drive signals and color differencedrive signal.

R-Signal

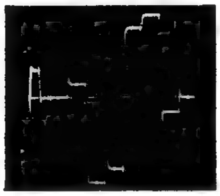


G-Signal

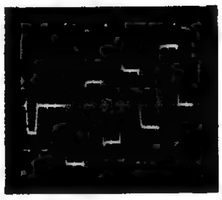


B-Signal

RGB drive signal



(R-Y)-Signal



(B-Y)-Signal

Color difference drive signal

6.7 Red area ㉞ and color screens ⑥

The monochrome color screens and especially the red screen serve primarily for checking and adjusting the color purity. Since the adjustment procedure at the deflection yoke can vary significantly between different models and manufacturers, the applicable service instructions should absolutely be followed.

6.8 Demodulator test pattern ㉟

This test pattern is intended especially for checking the PAL delay lines, 90% carrier offset, demodulators and G-Y matrix. **Signal BA$_V$ and BA$_U$** for checking the chroma channel up to the final color stages including image tube drive signals.

Achromatic vectors BA$_U$ and + BA$_V$ are suitable for checking the delay lines and aligning the color carrier phase shift of 90°.

Signal G–Y = 0. This differential signal is derived from the color difference signals R–Y and B–Y. The matrix assigned to this can be checked using this signal.

The vector of this signal is at 146°. When properly adjusted the G–Y matrix has an output voltage of 0 V. A faulty adjusted matrix can also be detected visually since the screen displays a color change. The white color corresponds to the skin color (146° phase position).

6.9 Linear grey scale ㊱

A first application of the linear grey scale is the visual check of the contrast and brightness controls. When the controls function correctly a setting can be reached in which eight steps can be clearly distinguished ranging from white to black. Gradation failure and distortions are not so easy to detect visually. However, deviations from setpoint values are easy to recognize on the oscilloscope screen. Advantageous is the use of a two-channel oscilloscope. It allows the direct comparison of the original signal and the output signal of the video amplifier.

6.10 Multiburst ㊲

This signal is designed for measuring the frequency response over the entire transmission range of television systems. It consists of 6 frequency groups superimposed upon one Y signal of 50% brightness and one reference bar of 100% white. The wave form of the group frequencies is sinusoidal. Group frequencies are 0.5 MHz, 1 MHz, 2 MHz, 3 MHz, 3.5 MHz, and 4.8 MHz.

Measurements are done preferably with an oscilloscope. However, limitations of in the definition are also detectable on the image screen. The frequency respose can either be referenced to the reference frequency of 1 MHz or to the 100% white bar.

6.11 Moving test pattern ⑤

This additional function is especially required for the service of video recorders. In order to test the tape run functions, time lapse, and still frame properties the white bar, wandering in steps from left to right, is inserted into the test patterns ㉘, ㉙, ㉚, ㉝, or ㉞.

6.12 White reference (test lines)

All test patterns are provided with a white reference consisting of 2 lines at the upper field edge which are not visible on the screen during normal playback. In recorder operation these white lines are required for the automatic mean value control. In addition, they serve as a 100% white reference level for oscilloscope measurements.

7 Electric circuitry

This description is based on the block diagram 40208-921.00.

7.1.1 Video clock, color carrier oscillator, color carrier coupling, 25 Hz offset

Main component on the clock PCB is the video IC S 178 A (IC 4). Supplied with the right input pulses (625 lines /50 Hz, f_{in} = 1.00 MHz; 525 lines/60 Hz, f_{in} = 1.007 MHz) it provides the relevant signals for video systems like blanking signal A, synchronization signal S, horizontal pulse H, vertical pulse V, frame signal V/25, and the like.

Furthermore, this IC can be switched over to all other standards. The number of equalizing pulses, main pulses, and blanking pulses are switched over via pins 23, 24 and 25, and the number of lines is switched over via pins 2 – 11. The input signal for the S 178 A is generated by the 4:1 divider (IC 2) from the VCO-type oscillator T11, Q2, D7 (T12 impedance converter, IC 3/10 level converter).

The VCO (T11) oscillates with 4.00 MHz for all 50 Hz standards. In case of 60 Hz standards, a 4.0279 Hz crystal will be installed. Since the FG 70 operates color-carrier coupled with all standards, a phase control loop is required between the color carrier oscillator (T17) and the oscillator of the IC's forming the clock pulse generator.
T7 and Q1 form the color carrier oscillator.

T9 and T10 feed the oscillator circuit L1, C15, that is damped by resistor R29. The magnitude of the constant voltage level of R29 is primarily determined by R17 and independent of the amplitude of the oscillator signal. The low-resistance color carrier signal is available via T4 and T7. T3 together with T7 function as a sample-and hold circuit. IC 7, R3, R4, C2, and C6 form a low-pass filter and control voltage amplifier. The color carrier is taken from the sample-and-hold transistor T3 at a certain time and the capacity diode D7 of the clock oscillator is pulled to this level via the control loop. For the standard B,G the line frequency f_H and the color carrier frequency f_F are interrelated according to the equation:

$$f_H = \frac{4}{1135} \cdot (f_F - 25) \ \text{[Hz]} \qquad (1)$$

or

$$\frac{f_H}{4} = \frac{f_F}{1135} - \frac{25}{1135} \ \text{[Hz]} \qquad (2)$$

When disregarding the factor $\frac{25}{1135}$ called the 25 Hz offset, one can see that exactly 1135 color carrier oscillations fit into the time period of 4 lines. This is the reason for the 4:1 divider formed by IC 6 for the horizontal signal A (H) (IC 7/4) so that IC 6/15 and IC 6/1 provide the signals $F_H/2$ and $f_H/4$, respectively. The signal is fed to the 25 Hz offset circuitry. The sample pulse is formed by IC 3/4 and the RC network R39/C35 and reaches the sample transistor T3 via the rapid level converter T1, T2.

The 25 Hz offset is not produced by a modulator but by a monostable multivibrator serving as the pulse width modulator. Taking again equation ② one could also say:

$$\frac{f_H}{4} + \frac{25}{1135} = \frac{f_F}{1135} \ \text{[Hz]} \qquad (3)$$

which means adding the factor = 0.022026 Hz to $f_H/4$. Thus, the time difference per sample pulse is:

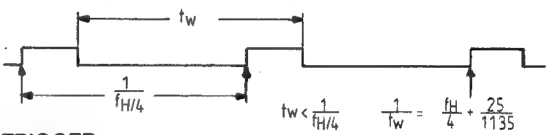
$$\frac{1}{\frac{f_F}{1135}} - \frac{1}{\frac{f_H}{4}} = 1.4435 \ \text{[nsec]}$$

Therefore, a time interval of 40 msec (25 Hz) contains

$$\frac{40 \cdot 10^{-3}}{\frac{1}{f_F/1135}} = \frac{40 \cdot 10^{-3}}{1135} \cdot f_F = 156.250881 \text{ oscillations}$$

This requires the pulse width modulator to allow an overall pulse width change of 225.548 nsec = 1 color carrier oscillation based on 25 Hz.

IC 5, functioning as a pulse width modulator, receives pulses of the frequency $f_H/4$ at pin 5. The time is determined by the RC network (R41, C27) which is no longer connected to the fixed operating voltage but to the fixed voltage with a superposed 25 Hz ramp signal. As the voltage increases at the RC network, the pulse width of IC 5 decreases f.e. the time interval from one pulse to the next is reduced which means that the frequency has increased.



TRIGGER
TIME OF THE
MONOVIBRATOR

R44, C34 and T16 produce the ramp that is decoupled through T15 and reaches the monovibrator via T14. The sample pulse is formed by R39/C35 and IC 3.

7.1.2 Burst code pulse generation

In order to realize the burst blanking (quadruple sequence) as defined in the PAL specifications, a special burst code pluse generation is required. To achieve this, 155 PAL meander are counted (IC 8 for counting, IC 9, IC 12 for decoding of various standards, 155 for PAL BGIN), starting from the time of the vertical pulse (start of main equalization pulses).

A reset pulse from IC 5/10 resets the counter IC 8. This monovibrator is triggered by the vertical pulse. The pulse is decoded according to the used standard and fed to the LOAD input of the programmable counter (IC 11) that executes the actual burst blanking during the

pre-, main-, and post-equalization pulses. The burst position and burst width are fixed to the rear black porch by IC 10. This pulse is called the burst code pulse (burst flag).

7.1.3 Output stages

T5 and T6 form the B amplifier for the color carrier signal available at the rear panel with appr. V_{PP} = 2 V at 75 Ω.

7.2 Decoder board 40208-720.00

7.2.1 Oscillator for video pattern genera-eneration

IC 2 serves as the clock oscillator which is coupled to the two-fold line frequency via a PLL loop that is also contained in IC 2. The oscillator oscillates with a frequency of 20 · f_H = 312.5 kHz and IC 1 divides the frequency by 10. Now it is compared to $2f_H$ from the IC of the clock generator (IC 2/24,3). R3, R4, C5 and C6 form a loop filter.

R1, C1 and IC 5/8,9,10 represent a delay network and center the video pattern in horizontal direction.

7.2.2 Counter for RGB generation

After appropriate clock pulse processing by IC 3/10, the clock frequency reaches IC 9/15. This counter outputs the signals Red, Green, Blue. IC 5/3,4 is connected to form an RS flip-flop and inhibits pulse counting following the last bar (black) to prevent the last bar from reappearing in white.

For generating color areas the programming inputs of IC 9 are influenced from the color area storage IC 6. A front panel advance button (color change) alters the counter status of IC 6 so that all colors contained in the color bars are available for color areas (including white and black).

The RC network R7, C8 serves to set red as the default state.

7.2.3 Grid, dot pattern generation

The vertical grid pulses are generated by R5/C1, IC 8/6 functioning as a slope discriminator, and IC 7/11. IC 4 counts the lines and is reset by the applicable decoding IC 7/8, 9, 10 (IC 4/2). The horizontal and vertical grid lines produced in that fashion are tied together by an OR gate (IC 10/4) and fed via the keying circuit (IC 15/9) to a four-fold OR gate (IC 18/9) which ties all digital video patterns to one output signal.

To produce the dot pattern, both grid pulses are tied by an AND gate and supplied to IC 18/11.

For generating the checkerboard all vertical and horizontal grid lines are divided by 2 (IC 13/15 for vertical lines, IC 13/1 for horizontal lines), tied together by an exclusive OR gate and made available after required keying (IC 18/10).

7.2.4 Clock pulse generation for multiburst and demodulator test pattern

The clock pulse for the multiburst signal and the demodulator test pattern is the output signal for vertical lines after the division by 2 (IC 13/15) used for the checkerboard. The multiburst keying signal is generated by IC 16, IC 17/11, 10 and IC 21/11, 10.

7.2.5 Moving test pattern

A white bar of 1 grid square in width and 2 grid squares in height can be superimposed upon the grid pattern, dot pattern, checkerboard, color bars, and color areas. The white bar moves from left to right in 16 steps advancing 1 step per second. The programmable backward counter with decoded zero output (IC 11/12) is triggered by a counter (IC 12).

In this way, the Q outputs of IC 12 are coupled to the programming inputs of IC 11. The A signal (IC 11/3) is used as load pulse and the clock pulse of the color bar counter (IC 11/6) serves as the clock signal. Depending on the counter status of IC 12 that is clocked by the V pulse, the backward counter IC 11 reaches sooner or later the zero status which means that the decoded zero moves from the left towards the right.

7.2.6 Test line generation

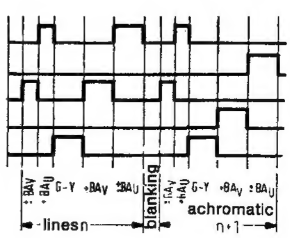
Two white reference lines are contained in each field and used as reference value for automatic level keeping. These are lines number 17 and 18 in the first field and lines number 330 and 331 in the second field. Since the test lines appear during V blanking a 1-of-N counter (IC 22) is reset by the V pulse (IC 22/15) and clocked by the H signal which is not blanked during the equalization pulses. The counter is blocked as soon as it has completed one sequence and is reset only by the V pulse in the next field.

The appropriate outputs (IC 22/6, 8) are tied together by IC 14 and fed to IC 18.

7.3 Color board 40208-830.00

7.3.1 Generation of the demodulation test pattern

The timing of the vectors is determined by a 1-of-N counter (IC 9) which is controlled by the decoder board (IC 3/6 for resetting, IC 15 for clocking). Not the color carrier of the modulator, but already the vector pulses are used for generating the achromatic errors. This is achieved through IC 7/3, 4, 10, 11 which is triggered by the PAL square and the vector pulses.



Generation of the vectors and achromatic fields

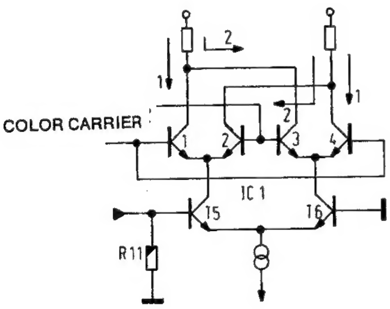
7.3.2 (B-Y) and (R-Y) matrixing

The transistor array IC 5 is wired as an operational amplifier. Its inverting (IC 5/2) or non-inverting input is connected in such a fashion that it meets the matrixing requirements for (B-Y). It is triggered by the signals red, green, blue as well as by the burst code pulse and the corresponding vectors. The (R-Y) branch is realized through IC 4. The color differential signals are limited to appr. 1.3 MHz by L3, C29, C24, C27, C26, R54, and R55 according to the PAL standard and are then fed to the respective modulator input. The different reduction factors for the differential signals are achieved in the modulators by differing amplification factors (R49, R48; R12).

7.3.3 U and V modulators, carrier processing, PAL switch-over

The U modulator is IC 3 and the V modulator is IC 2. This modulator uses a switching carrier according to the current distribution principle and works with carrier suppression in the quadrature modulation used in PAL. The 90° carrier offset required for the quadrature modulation is achieved in the (B-Y) branch with a high-pass filter C4, R11. In the (B-Y) branch the carrier is fed via the decoupling transistor T2 to the carrier input of the modulator (IC 3/10, IC 3/8 is at a fixed level).

In the (R-Y) branch the carrier passes at first the PAL switch that is also set up using a modulator IC (IC 1); the color carrier is fed to the modulation input IC 1/1 and the rectanguler PAL switching pulse is fed to the carrier input IC 1/10. This crosswise connection of the carrier switchover transistors in the IC results in a line-by-line rotation of the carrier by 180°.



T1, T4 or T2, T3 become alternatingly conductive so that the driver transistors are connected to the load resistors alternatingly crosswise and directly.

Leaving the PAL switch, the carrier reaches the (R-Y) modulator which is fed with differential signals to compensate for different amplitudes resulting from unsymmetries of the PAL switching IC. Both modulator outputs are connected to a common load resistor R27 which is preceded by a filter (L1, C13, C14, C12). The purpose of the filter is to suppress all harmonics generated during the modulating process. Therefore, L1/C14 is rated for the 3. harmonic of the color carrier which is particularely evident at the modulator output. T3 serves to decouple the chroma signal. The base of T5 is connected via R32 to the chroma ON/OFF button on the control panel.

7.4 Multiburst board 40208-740.00

7.4.1 Function generator with window comparator, sine-wave network.

The 1-of-N counter IC 4 triggered by the decoder board supplies from the OP IC 3 a staircase voltage that is desolved by the line frequency due to the different resistors R7 to R16. After appropriate level conversion achieved by IC 2/T3, this staircase voltage controls the OP IC's 1/T1 and 2/T2 that are connected as constant current sources. The condensor C7 is charged once through transistor switches T5/T6 and T9/T10 once via T1/T6 and is discharged via T2/T10; this means that T6 and T9 are conductive and T5 and T10 are inhibited during the charging phase while the transistor status is reversed during the discharging phase. C7 carries a triangular voltage that is fed via T13/T14 and the voltage divider T54/R55 to the window comparator IC 5 which determines the magnitude of the triangular voltage. The comparator switching points are set by R59/R50 for the negative phase and by R56/R57 for the positive phase and are at appr. ± 1.1 V.

Two TTL gates (IC 5/9, IC 5/4) with strobe inputs (5/5, 5/8) follow the comparators and are connected as a RS flip-flop to switch the FF to the complementary state when the switching point is reached. The switching transistors T5, T6 and T9, T10 are triggered to the correct positive or negative sign by the level converting circuit T7, T8 and T11, T10.

The following diode network (D13, 15, 18, 19, 20, 21) converts the triangular voltage present at R38/39 to a sinusoidal voltage by stepwise approximation. The sinus wave is then decoupled via T26 and supplied to the video board.

7.4.2 Start-stop circuitry

Since the multiburst signal must be blanked during line flyback and should be synchronized with the line frequency, a start-stop circuit is required.

For this, T16, T17 form a differential amplifier which is connected with its connector (T16) to the holding diode D6. D12 will be inhibited as soon as the gating pulse is present at connector 740.01/13 0. If the base of T16 becomes now positive via the voltage divider D10/R41 in reference to the voltage at the base of T17, this transistor becomes conductive and maintains through D6 the voltage level at C7. A voltage level will build up at R7/R39 which is by the zener voltage higher than the level adjusted with R45 (appr. 0 V).

If the gating pulse becomes high, the differential amplifier T16/T17 will be inhibited because of T20, T12, and T11. Also D6 is non-conductive and C7 is being recharged.

7.4.3 Circle generation, line thickness circuit, position shifting

The common circle equation is $x^2 + y^2 = r^2$. In reference to the image screen this means that a circle results when adding a quadratic function in horizontal and another quadratic function in vertical direction.

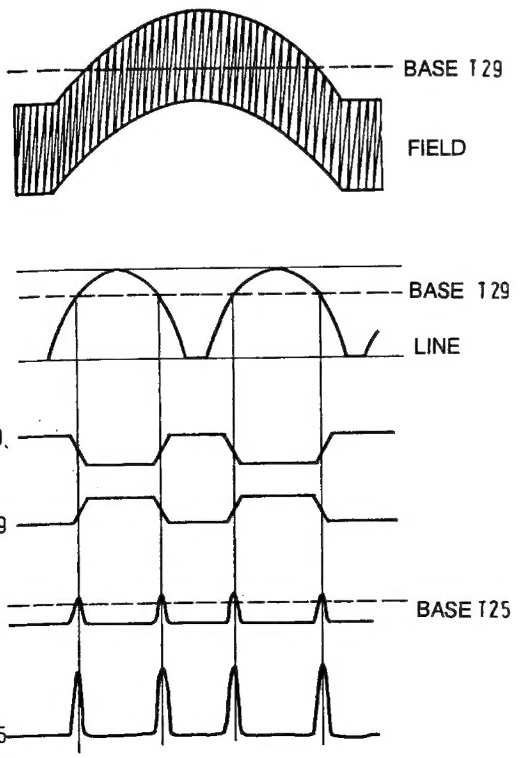
Two integrators each for field and for line functions produce a line parabola (IC 6/8) and a field parabola (IC 6/7) from the reference dc voltage.

(1. integration: sawtooth IC 6/14; 2. integration: parabola IC 6/8).

The transistors (T21, T22, T27, T28) discharge the condensers during the line and field flyback, respectively. R R99 is used to adjust the elliptical ratio which represents the relation of the amplitudes of both components to each other. The field parabola with the line parabola superimposed upon it is the voltage at the base of T30.

A comparator T29/T30 compares the voltage level at the base of T29 to the parabolas at T30. Thus, the collectors carry rectangular voltage signals having time bases that represent a complete circle with regards to the entire screen. To produce a circular ring, the slopes are rectified by D24/D25 so that R86 receives only pulses at the time the slopes occur. An additional comparator circuit cuts away the upper part of the pulses so that the pulse width and thus the line thickness can be adjusted by adjusting the cutting level at T25. A careful temperature compensation for each comparator ensures a good temperature stability for the whole circle generating circuit.

The horizontal and vertical position shift is achieved by IC 7 which generates the discharge pulses for the integrators. This IC is clocked by field pulses and the horizontal pulses.



Oscillograms from the circle generation

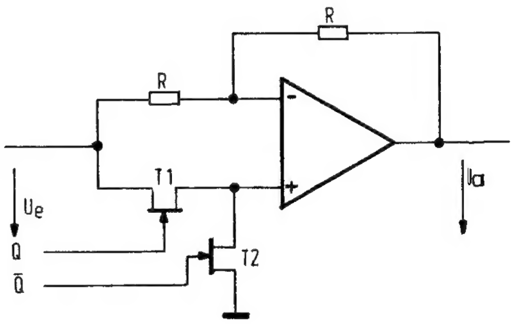
7.5 Video board 40208-750.00

7.5.1 Adding image patterns, generation of linear grey scale

Transistors R1, T2, T3, T4 and D1 form an operational amplifier with resistors connected to its summation points that are fed with the respective pulses of the image patterns. These pulses are supplied by the decoder board and pass a buffer IC 3, IC 1 to clear the signal from spikes, etc. The RC components at the RGB inputs provide phase equalization for the luminance and chrominance signals. The synchronization signal is fed to the non-inverting input (T2) of the operational amplifier.

The linear grey scale is produced by IC 2 and resistors R9, R10, R11 that are arranged according to their significance 1-2-4 and are also connected to the summation points of the operational amplifier.

The following filter ensures a defined rise time of appr. 100 nsec. This filter feeds another operational amplifier (T5, T6, T7, T8, D5) through its load impedance R36. Also the chroma and multiburst signal are fed to this summation point (R39-R42). This composite video color signal is decoupled by T15/T16 and applied to the vision carrier assembly. Simultaneously, the signal from D5/R34 reaches another operational amplifier that operates as a bipolar coefficient stage with gain 1. This OP reverses the polarity of the video signal depending on the position of the front panel switch. The advantage of this circuitry is that no potential shifting takes place which means that the video signal is simply reflected on the black porch.



Polarity reversal

When T2 is conductive and T1 is inhibited, the non-inverting input of the operational amplifier is connected to ground and the OP is an inverting amplifier, $V_{out} = -V_{in}$.

When T2 is inhibited and T1 is conductive, the input signal V_{in} is fed to the non-inverting input which causes the voltage drop across R to become 0, $V_{out} = V_{in}$.

7.6 Basic board 40208-700.00

7.6.1 Final video stage

The video signal is fed through R63 to the basic board and from there to the video potentiometer at the front panel. Via a switch for calibrating the video amplitude to $V_{pp} = 1$ V at 75 Ω, the signal returns to the basic board and from there to the final stage.

This circuit consists of an operational amplifier with class-B push-pull final stage and has a low-source impedance of appr. 1 Ω. It offers the advantage of making both slopes almost equally long. Through R18 the video signal reaches the BNC socket on the front panel and through R17 the AV socket on the rear panel.

7.6.2 Current supply

The basic board also contains the current supply with the exception of the interconnecting cables between the boards. Required are supply voltages of +12 V/800 mA and −12 V/400 mA which are generated by fixed-voltage IC's. For tuning the capacity diodes, an additional voltage of appr. 38 V is necessary. As this voltage serves only one OP it is produced by the zener diodes D1/D2 and the subsequent transistor T1. Then it is added to the +12 V supply voltage. The zener diodes D3, D4 as well as D1, D3, and D4, located on the power supply board, limit the voltage by a longitudinal controlled termination and, at the same time, protect the IC's in case of negative input voltages.

A switch on the rear panel allows to feed the pulses of the blanking, vertical, and pattern signals to a 75Ω pulse end stage of push-pull design (T8, T9) which is connected to the trigger output on the rear panel.

Also on the rear panel are a BNC connector for the chroma carrier as well as an AV socket and a DIN socket for receiving external AF signals.

The video signal, supply voltage +12 V, control voltage +12 V and the AF signals for stereo or dual sound are present at the AV socket.